

1.3 Government intervention – Indirect taxes

Learning Outcomes

- Explain the government intervention of imposing indirect (excise) taxes.
- Show the distinction between specific and *ad valorem* taxes.
- Draw diagrams to show specific and *ad valorem* taxes, and analyse their impacts on market outcomes.
- Discuss the consequences of imposing an indirect tax on the stakeholders in a market, including consumers, producers, and the government.

Synonyms

| | |
|----------------|---------------------------|
| levied | placed, imposed |
| expenditure. | spending/ money spent |
| recuperate .. | get back/ recover |
| imposition .. | introduction |
| incentive..... | encouragement/ motivation |

Subject vocabulary

specific tax a charge expressed as a monetary value that producers pay on each unit of a good sold

ad valorem tax a tax based on a percentage of the price such as value added tax (VAT) and sales tax

producer a business that makes goods

income tax a direct tax on individual earnings (wages, rent, profit, interest) and paid to the government

direct taxes a tax that is paid directly by an individual or firm to the government. For example income tax on wages and company profits.

costs of production the amount the firm pays for the factors of production used to produce goods or services

unit of output a single good or service produced by a firm

purchasing power a measure of how many goods and services a given amount of money can buy

normal goods goods for which demand increases when income increases, and falls when income falls

real income income after taking into account the effects of inflation on purchasing power

What is the distinction between specific and *ad valorem* taxes?

An indirect tax is a tax **levied** on **expenditure**. A **specific tax** is a charge expressed as a monetary value that producers have to pay for each unit of a good they sell. It is a per-unit tax or a flat-rate tax. An example is an excise tax or duty which is a tax placed on a selected number of goods, such as tobacco and alcohol.

Ad valorem tax is a charge that producers have to pay for each unit of a good they sell, but expressed as a percentage of the price of the good.

The **producer** pays the tax to the government. The producer must raise the price the consumer pays for each unit in order to **recuperate** the tax. It is called an indirect tax because the tax is not paid directly by the consumer to the government, unlike an **income tax** which is a **direct tax**.

Model sentence: The effect of a tax is to increase the producer's **costs of production**. When a tax is placed on a **unit of output** or an existing tax is increased **profit at each price falls**. Therefore the producer will reduce supply and the supply curve shifts up and to the left.

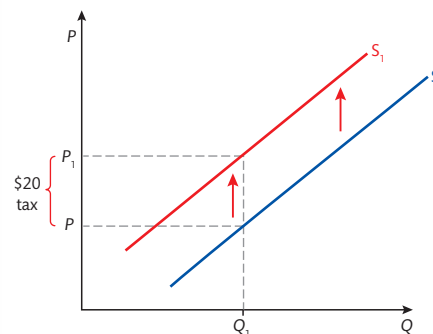


Figure 13.1

As shown in Figure 13.1 the placement of a specific per-unit tax of \$20 causes a parallel shift of the supply curve up and to the left (S to S_1) at each level of output by the amount of the tax.

As shown in Figure 13.2 the **imposition** of an *ad valorem* tax causes the supply curve to pivot anti-clockwise around the quantity supplied when price equals zero (S to S_1). The tax is a percentage of the price therefore as price increases the amount of tax increases and the distance between S and S_1 gets bigger. For example, when the rate of a sales tax is 20% and price is \$100 the amount of tax is \$20. When the price is \$250 the amount of tax is \$50.

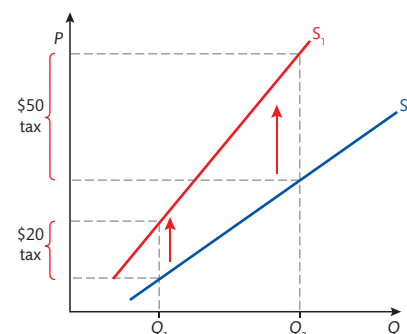


Figure 13.2

How does a tax affect consumers, producers, and the government?

A tax increases the price consumers have to pay thereby reducing the **purchasing power of income**. This means fewer goods can be bought with the same income and therefore consumption falls.

After a tax is levied consumers have less disposable income to spend and therefore demand for **normal goods** falls.

As demand falls producers of taxed goods reduce output because people are buying fewer goods.

Producers need fewer workers and unemployment increases. Government will therefore have to pay more in welfare payments.

A tax placed on raw materials increases firms' costs of production leading to a fall in profit at each price. There is now less **incentive** to supply so the producer reduces supply causing the supply curve to shift up and to the left. The price of the final good increases leading to a fall in consumers' **real income**.

The increase in costs leads to a fall in international competitiveness. The higher price causes consumers to substitute **imported goods** for domestically produced goods.

The imposition of tax can lead to **inflation**. The disadvantages of inflation are discussed in detail on pages 149–50.

Model sentence: When a tax is levied on a normal good demand falls due to higher prices, producers reduce output, and unemployment in the industry increases. A tax on raw materials increases firms' costs of production, price therefore rises and the firm becomes less internationally competitive leading to higher unemployment in exporting industries.

The government must raise **tax revenue** to pay for the provision of goods and services that would be underconsumed and undersupplied if left to the **free market**. (This will be discussed later in the chapter on market failure.) A tax generates revenue for the government that it can use to provide things such as **infrastructure**, healthcare, education, the armed forces, and **welfare payments**.

There are many effects of a tax on the economy and these will be discussed further in later units.

Test your understanding of this unit by answering the following questions

- Distinguish between a direct tax and an indirect tax.
- Using diagrams to illustrate your answer, explain the difference between a specific tax and an *ad valorem* tax.
- Discuss the effect the imposition of a tax has on a consumer.

Subject vocabulary

imported goods goods sold into a country from another country

inflation an increase in the general level of prices of goods/ services in an economy over a given time period, usually a year

tax revenue the income the government receives through the levying and collection of taxes

free market a market where the forces of demand and supply are allowed to operate without any forms of intervention

welfare payment a payment made by the government to someone, usually because the person is unemployed or earns a low income

Glossary

infrastructure the basic structure/systems of a country (e.g. roads/railways)

Learning Outcomes

- Explain, using diagrams, how the **incidence** of indirect taxes on consumers and firms differs, depending on the **price elasticity of demand** and on the **price elasticity of supply**. (HL)
- Plot demand and supply curves for a product from **linear functions** and then illustrate and/or calculate the effects of the imposition of a specific tax on the market (on price, quantity, consumer expenditure, producer revenue, government revenue, consumer surplus, and producer surplus). (HL)

What are the effects on price and quantity of the imposition of a specific tax (HL) – a step-by-step guide

Trouble shooter (see Figure 14.1 and Figure 14.2)

The tax causes the supply curve to shift up and to the left by the amount of the tax (from S to S_{tax}) because the tax rate is given by the vertical distance between the original and new supply curves.

The firm wants to make consumers pay all the tax by setting price at P_2 .

However at P_2 quantity supplied > quantity demanded. To eliminate the **excess supply** price must fall from P_2 to P_{tax} .

Price increases from P_e to P_{tax} and quantity falls from Q_e to Q_{tax} .

Synonyms

incidence occurrence/ frequency

Subject vocabulary

price elasticity of demand (PED) a measure of how quantity demanded responds to a change in price in percentage terms

price elasticity of supply (PES) a measure of how quantity supplied responds to a change in price in percentage terms

linear function an equation, the graph of which is a straight line

excess supply occurs when quantity supplied is greater than quantity demanded

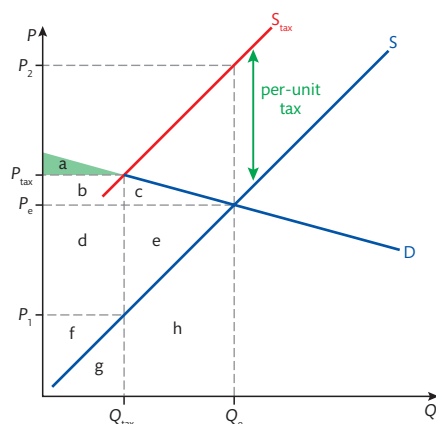


Figure 14.1

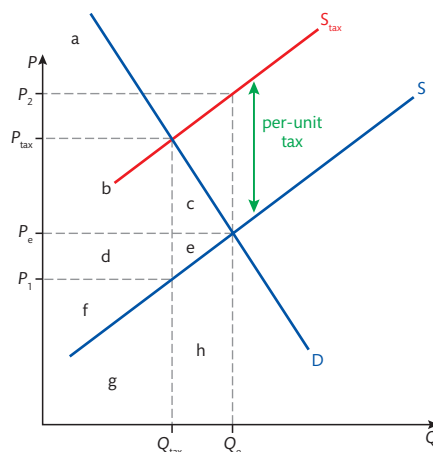


Figure 14.2

Model sentence: The producer wants to pass on all of a tax imposed on a good to the consumers to pay, but increasing the price by the full amount of the tax causes excess supply at that price and therefore price must fall in order to eliminate the excess.

The incidence of tax (HL) – a step-by-step guide (see Figures 14.1 and 14.2)

Trouble shooter

Total expenditure = $P_{\text{tax}} \times Q_{\text{tax}}$, areas b, d, f, and g.

Tax per-unit is $P_{\text{tax}} - P_1$.

Total **tax revenue** = $(P_{\text{tax}} - P_1) \times Q_{\text{tax}}$, area b + d

Amount of tax paid by the consumers = $(P_{\text{tax}} - P_e) \times Q_{\text{tax}}$, area b

Amount of tax paid by the producer = $(P_{\text{tax}} - P_1) \times Q_{\text{tax}}$, area d

Amount of **producer revenue** kept by the producer = $P_1 \times Q_{\text{tax}}$, area f + g

What is the effect of the imposition of a specific tax on consumer and producer surplus (HL) – a step-by-step guide

Trouble shooter

Consumer surplus is the difference between the price consumers are willing to pay and the price actually paid. It is the area above **market price** and below the **demand curve**:

Consumer surplus before tax: area a + b + c

After a tax is added the price increases from P_e to P_{tax} .

Consumer surplus after tax: area a

Loss of consumer surplus: area b + c

Producer surplus is the difference between the price the firm is willing to take and the actual price received. It is the area below the market price and above the supply curve.

Producer surplus before tax: area d + e + f

After tax the amount the firm receives falls from P_e to P_1 .

Producer surplus after tax: area f

Loss of producer surplus: area d + e

Subject vocabulary

tax revenue the income the government receives through the levying and collection of taxes

producer revenue the income a firm receives from consumers in exchange for goods (revenue = price \times quantity sold)

consumer surplus the difference between the price a consumer is willing and able to pay and the price the consumer actually pays

market price the price determined by the interaction of demand and supply in a competitive market

demand curve a graph that shows the relationship between price and quantity demanded

producer surplus the difference between the price a firm is willing to accept for a unit of output and the price the consumer actually pays

Welfare loss caused by a tax (HL) – a step-by-step guide

Trouble shooter

Loss of consumer surplus: area b + c

b is not lost by society because it is tax revenue which now benefits the government.

c was a benefit to consumers and is lost completely.

Loss of producer surplus: area d + e

d is not lost by society because it is tax revenue.

e was a benefit to the producer and is lost completely.

c and e is the deadweight **welfare loss** of the tax.

What are the effects of PED and PES on the incidence of tax? (HL)

In Figure 14.1 the value of **PED** > the value of **PES**. **Demand** is more **price elastic** than **supply**. Quantity demanded is relatively more **responsive** to a change in price than quantity supplied. Producers are not able to pass on a large amount of the tax to the consumers because quantity demanded would fall too much. The producer must pay most of the tax therefore $d > b$.

In Figure 14.2 the value of **PES** > the value of **PED**. **PED** is less price elastic than supply. Quantity demanded is relatively less responsive to a change in price than quantity supplied, therefore producers are able to pass on most of the tax therefore $b > d$.

When demand is more **price inelastic**, *ceteris paribus*, tax revenue is greater because as price increases consumers continue to buy the good in similar quantities. Tax is paid on a larger number of goods than when demand is more price elastic.

Model sentence: The **incidence of tax** is determined by the **price elasticity of supply and demand**. When **supply** is more **price elastic** than **demand** most of the tax is paid by the **consumer**. If **demand** is more **price elastic** than **supply** producers will pay most of the tax.

Show the effect of a tax using linear functions (HL)

See pages 5–6 and 9–10 to find out how to plot the demand and supply curves from the functions $Q_d = 2000 - 200P$ and $Q_s = -400 + 400P$ for prices from \$0 to \$6.

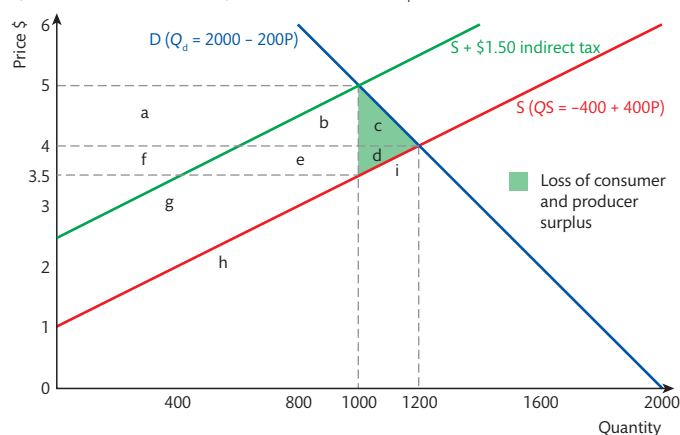


Figure 14.3

Equilibrium price increases from \$4 to \$5 and quantity falls from 1200 to 1000 units.

Tax revenue is = tax per unit \times quantity = $\$1.50 \times 1000 = \1500 . It is the area a + b + e + f.

Tax paid by consumers is area a + b. Price has risen by \$1 therefore consumers are paying \$1 of the \$1.50 per-unit tax. The total amount of tax that consumers pay = $\$1 \times 1000 = \1000 .

Tax paid by the producer is area f + e. Consumers pay \$1 of the \$1.50 tax therefore the producer must pay \$0.50 per unit. The amount of tax the producer pays = $\$0.50 \times 1000 = \500 .

Subject vocabulary

welfare loss the sum of the loss of consumer and producer surplus caused by market or government failure

price elasticity of demand (PED) a measure of how quantity demanded responds to a change in price in percentage terms

price elasticity of supply (PES) a measure of how quantity supplied responds to a change in price in percentage terms

demand the amount of a good that consumers are willing and able to buy at each price

price elastic the percentage change in quantity demanded/supplied > the percentage change in price

supply the amount of a good that a firm is willing and able to produce at each price

price inelastic the percentage change in quantity demanded/supplied < the percentage change in price

ceteris paribus Latin phrase meaning 'all other things being equal' or 'all other things being held constant'

incidence of tax the amount of a tax that is paid by the consumers and the amount paid by the producer

equilibrium price the price at which the quantity consumers are willing and able to buy is equal to the quantity firms are willing and able to produce

per-unit tax a set charge on each particular unit of a good that is sold

costs of production the amount the firm pays for the factors of production used to produce goods or services

parallel shift a change in the location of a curve (demand or supply, for example) after which the new curve is the same distance from the original curve at every point

Synonyms

responsive reactive/
sensitive

Synonyms

expenditure..... spending/
money spent

Subject vocabulary

social surplus the sum
of consumer surplus and
producer surplus

consumer welfare a measure
of the benefit obtained from
the consumption of goods

producer welfare measure
of the benefit gained by a firm
from the sale of goods

equilibrium quantity the
output that results when
quantity demanded is equal to
quantity supplied

output the quantity of goods
produced by a firm, industry
or economy

costs of production the
amount the firm pays for the
factors of production used to
produce goods or services

supply the amount of a good
that a firm is willing and able
to produce at each price

supply curve a graph that
shows the relationship
between price and quantity
supplied

excess supply occurs when
quantity supplied is greater
than quantity demanded

quantity traded the number
of goods bought and sold

Original consumer **expenditure** (price \times quantity) is $\$4 \times 1200 = \4800 . This is area $e + d + f + g + h + i$. Expenditure after tax is represented by the area $a + b + f + e + g + h$.

Consumer surplus is the area above price and below the demand curve. After the increase in price the consumer loses area $a + b + c$ of consumer surplus.

Area $a + b = \$1 \times 1000 = \1000

The area of the triangle $c = \frac{1}{2} \times \text{the base} \times \text{the height} = 0.5 \times 200 = \100

Loss of consumer surplus = $\$1000 + \$100 = \$1100$

Original producer revenue (price \times quantity) is $\$4 \times 1200 = \4800 . This is area $e + d + f + g + h + i$. The revenue after tax, area $g + h$, is $\$3.5 \times 1000 = \3500 , a decrease of $\$1300$.

Producer surplus is the area below price and above the supply curve. After the tax the producers lose area $f + e + d$ of producer surplus.

Area $f + e = 0.5 \times 1000 = \500

The area of the triangle $d = \frac{1}{2} \times \text{the base} \times \text{the height} = 0.25 \times 200 = \50

Loss of producer surplus = $\$500 + \$50 = \$550$

Total loss of **social surplus** = loss of consumer surplus + loss of producer surplus = $\$1100 + \$550 = \$1650$. Not all of this amount is lost completely because $\$1500$ of it goes to the government and is used to buy goods and services. The welfare loss caused by the tax = $\$1650 - \$1500 = \$150$. This is area $c + d$.

Consumers pay most of the tax because demand is more price inelastic than supply at $\$4$ therefore producers can pass on the majority of the tax to consumers.

Consumer welfare loss is greater than the **producer's welfare** loss. The increase in price paid by the consumer is greater than the decrease in price received by the producer.

Test your understanding of this unit by answering the following questions

- Explain what determines the incidence of tax.
- Using the functions $Q_d = 1600 - 200P$ and $Q_s = -200 + 200P$ plot the demand and supply curves for prices from $\$0$ to $\$6$. A per-unit tax of $\$1$ is imposed. Draw the new supply curve. Show the new equilibrium price and **equilibrium quantity**. Calculate the tax revenue, the amount of tax paid by the producer and the consumer, the change in expenditure and producer revenue, and illustrate the welfare loss.

Learning Outcomes

- Explain the government intervention of providing subsidies and describe examples of subsidies.
- Draw a diagram to show a subsidy and analyze the **impacts** of a subsidy on market outcomes.
- Discuss the **consequences** of providing a subsidy on the stakeholders in a market, including consumers, producers, and the government.
- Plot demand and supply curves for a product from linear functions and then illustrate and/or calculate the effects of the provision of a subsidy on the market (on price, quantity, consumer expenditure, producer revenue, government expenditure, consumer surplus, and producer surplus). (HL)

Synonyms

impacts..... effects

consequences... results/
outcomes

firm..... business/
producer/supplier

incentive... encouragement/
motivation

eliminate .. remove/get rid of

Subsidies are payments made by government to **firms**, per unit of **output**. A subsidy reduces **costs of production** increasing profit per unit at every price. This provides an **incentive** for firms to increase **supply**. The **supply curve** shifts down and to the right by the amount of the subsidy because the vertical distance between the original supply curve and the new supply curve represents the unit value of the subsidy. Price falls from P_e to P_{sub} in order to **eliminate** the **excess supply** and **quantity traded** increases from Q_e to Q_{sub} .

What are the effects of a subsidy on producer revenue and consumer and government expenditure? (see Figure 15.1) – a step-by-step guide

Trouble shooter

$P_1 - P_{\text{sub}}$ is the size of the subsidy on each unit.

Government expenditure on the subsidy = $(P_1 - P_{\text{sub}}) \times Q_{\text{sub}}$ (area b + c + d + e + f + g + h).

Supply curve shifts down and to the right from S to S_{sub} .

Price falls from P_e to P_{sub} .

Quantity traded increases from Q_e to Q_{sub} .

Consumer expenditure before subsidy = $P_e \times Q_e$ (area e + f + i + j + l).

And after subsidy = $P_{\text{sub}} \times Q_{\text{sub}}$ (area i + j + k + l + m).

Producer revenue before subsidy = $P_e \times Q_e$ (area e + f + i + j + l).

And after subsidy = $P_1 \times Q_{\text{sub}}$ (area b + c + d + e + f + g + h + i + j + k + l + m).

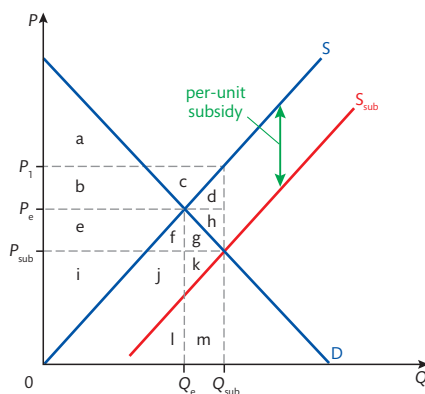


Figure 15.1

Model sentence: A subsidy lowers the price consumers pay causing quantity demanded and consumer surplus to rise. A subsidy increases the price producers receive and increases the output sold therefore producer revenue and producer surplus increases.

What are the welfare effects of a subsidy?

| | Before subsidy | After subsidy | Change in welfare |
|-----------------------|----------------|-------------------|-------------------|
| Consumer surplus (CS) | a + b | a + b + e + f + g | e + f + g |
| Producer surplus (PS) | e + i | b + c + e + i | b + c |

Table 15.1

The subsidy benefits consumers and producers. Consumers buy more at a lower price. This is an increase in CS. Producers sell more at a higher price. This is an increase in PS. To get the additional **welfare** the government must pay the subsidy. The subsidy = $(P_1 - P_{\text{sub}}) \times Q_{\text{sub}}$. This is area b + c + d + e + f + g + h. To work out the effect on **society's** welfare we subtract the costs from the benefits.

The gains in welfare (PS + CS) = b + c + e + f + g

Minus cost of subsidy = $\underline{b + c + d + e + f + g + h}$

Total welfare = $\underline{-(d + h)}$

The cost to society is greater than the benefits. Area d + h represents the welfare loss caused by the subsidy.

Should governments provide subsidies?

Governments give subsidies in order to lower price and increase **quantity demanded** of goods and services such as education and training that may benefit consumers and society. They do this to protect **domestic firms** and industries from cheaper imports to maintain sales and save domestic jobs, and to make sure a good such as a basic **agricultural** good is supplied by producers in the quantities needed. The welfare of the producers of the subsidized agricultural good also increases because they sell more goods at a higher price.

Subject vocabulary

government expenditure spending by a government in a specified period of time on such things as transport infrastructure, welfare payments, national defense, education, and health services which is financed by tax revenue and borrowing

consumer expenditure the money paid by consumers in exchange for goods

producer revenue the income a firm receives from consumers in exchange for goods (revenue = price × quantity sold)

consumer surplus the difference between the price a consumer is willing and able to pay and the price the consumer actually pays

producer surplus the difference between the price a firm is willing to accept for a unit of output and the price the consumer actually pays

welfare the benefit gained from consuming and producing goods

quantity demanded the amount of a good consumers are willing and able to buy at a given price over a given period of time

domestic firm a firm that produces its output in the home country

Glossary

society a group of individuals involved with each other in some way. In economics it often refers to the three main stakeholders, the consumers, the producers, and government

Synonyms

agricultural..... farming

Subject vocabulary

opportunity cost the next best alternative forgone

investment the addition to capital stock

surplus occurs when quantity supplied is greater than quantity demanded, another term for excess supply

resources the inputs into the production process, the factors of production

disposable income household income after direct taxation has been deducted

wants goods and services that people desire

consumer welfare a measure of the benefit obtained from the consumption of goods

demand curve a graph that shows the relationship between price and quantity demanded

supply curve a graph that shows the relationship between price and quantity supplied

linear function an equation, the graph of which is a straight line

demand schedule a table showing the quantity demanded over a range of prices – information that can be used to plot a demand curve

supply schedule a table showing the quantity supplied over a range of prices – the information can be used to plot a supply curve

equilibrium price the price at which the quantity consumers are willing and able to buy is equal to the quantity firms are willing and able to produce

equilibrium quantity the output that results when quantity demanded is equal to quantity supplied

Synonyms

scarce..... limited/finite

Glossary

infrastructure the basic structure/systems of a country (e.g. roads/railways)

There is a welfare loss and an **opportunity cost** of a subsidy. If the government spends money subsidizing an industry it is not able to spend it on something else such as **investment** in **infrastructure** that would bring benefits to society.

A subsidy encourages industries to increase supply. Goods can be over produced causing a **surplus** that cannot be sold and must be thrown away. This is a waste of the world's **scarce resources**. This happens in the agricultural industry for some goods after subsidies are given to farmers.

The government might increase taxes to pay for the subsidy. Consumers' **disposable income** falls and they can buy fewer goods and satisfy fewer **wants** leading to a fall in **consumer welfare**.

Test your understanding of this unit by answering the following question

- Using a demand and supply diagram explain the effects on welfare caused by a subsidy.

Explain the effect of a subsidy using linear functions (HL)

See pages 5–10 to find out how to calculate prices and quantities and how to plot **demand curves** and **supply curves** from **linear functions**.

| Price \$ | $Q_d = 30 - 4P$ | Q_d | $Q_s = 6 + 2P$ | Q_s |
|----------|------------------------------------|-------|----------------------------------|-------|
| 1 | $30 - (4 \times 1) = 30 - 4 = 26$ | 26 | $6 + (2 \times 1) = 6 + 2 = 8$ | 8 |
| 2 | $30 - (4 \times 2) = 30 - 8 = 22$ | 22 | $6 + (2 \times 2) = 6 + 4 = 10$ | 10 |
| 3 | $30 - (4 \times 3) = 30 - 12 = 18$ | 18 | $6 + (2 \times 3) = 6 + 6 = 12$ | 12 |
| 4 | $30 - (4 \times 4) = 30 - 16 = 14$ | 14 | $6 + (2 \times 4) = 6 + 8 = 14$ | 14 |
| 5 | $30 - (4 \times 5) = 30 - 20 = 10$ | 10 | $6 + (2 \times 5) = 6 + 10 = 16$ | 16 |
| 6 | $30 - (4 \times 6) = 30 - 24 = 6$ | 6 | $6 + (2 \times 6) = 6 + 12 = 18$ | 18 |

Set out in Table 15.2 is the **demand and supply schedule** for the functions $Q_d = 30 - 4P$ and $Q_s = 6 + 2P$.

The demand and supply curves are plotted from the information on the demand and supply schedule as seen in Figure 15.2.

Table 15.2

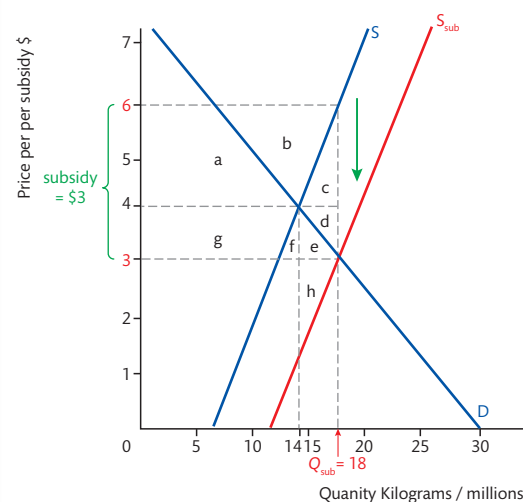


Figure 15.2

Calculate the **equilibrium price and quantity** and plot the new supply curve using the linear functions $Q_d = 30 - 4P$ and $Q_s = 12 + 2P$.

At equilibrium price $Q_d = Q_s$ therefore $30 - 4P = 12 + 2P$
 $30 - 4P = 12 + 2P$ Simplify by adding $4P$ to both sides
 $30 = 12 + 6P$ Simplify by subtracting 12 from both sides
 $18 = 6P$ Simplify by dividing both sides by 6
 $3 = P$

Put 3 in place of P in the linear function $Q_d = 30 - 4P$
 $Q_d = 30 - (4 \times 3)$
 $Q_d = 30 - 12$
 $Q_d = 18$

Now add a \$3 subsidy per unit. Producers get \$3 more per kilo than the consumers pay. The new linear supply function is:

$Q_s = 6 + 2(P+3)$ Simplify by multiplying 2 by $(P+3)$

$Q_s = 6 + 2P + 6$

$Q_s = 12 + 2P$

Set out below in Table 15.2 is the supply schedule for the supply function $Q_s = 12 + 2P$.

The new supply curve can now be plotted using the information from the supply schedule Table 15.3. The new supply curve S_{sub} is shown in Figure 15.2.

| Price \$ | $Q_s = 12 + 2P$ | Quantity supplied |
|----------|------------------------------------|-------------------|
| 1 | $12 + (2 \times 1) = 12 + 2 = 14$ | 14 |
| 2 | $12 + (2 \times 2) = 12 + 4 = 16$ | 16 |
| 3 | $12 + (2 \times 3) = 12 + 6 = 18$ | 18 |
| 4 | $12 + (2 \times 4) = 12 + 8 = 20$ | 20 |
| 5 | $12 + (2 \times 5) = 12 + 10 = 22$ | 22 |
| 6 | $12 + (2 \times 6) = 12 + 12 = 24$ | 24 |

Table 15.3

Calculate the addition to producer surplus (PS) due to a subsidy (HL) – a step-by-step guide

Trouble shooter

Producers receive an additional \$3 per unit sold after the subsidy.

The additional PS is the area below the new price of \$6 (the new equilibrium price + the subsidy per unit) and above the supply curve S.

It is represented by the area a + b.

To work out a + b calculate a + b + c and then subtract c.

Calculation of the area a + b + c

$$(6 - 4) \times 18 = 2 \times 18 = 36$$

Calculation of the triangle c

The area of a triangle is $\frac{1}{2} \times \text{the base} \times \text{the height}$

The base = 4 and the height = 2

$$\text{The area of c} = 0.5 \times 4 \times 2 = 2 \times 2 = 4$$

$$\text{Change in PS} = 36 - 4 = \$32 \text{ million}$$

Calculate the addition to consumer surplus (CS) due to a subsidy (HL) – a step-by-step guide

Trouble shooter

Price paid falls from \$4 to \$3 after the subsidy.

The additional CS is the area under the demand curve, above the new equilibrium price \$3 and below the original equilibrium price \$4.

It is represented by the area e + f + g.

To work out e + f + g calculate d + e + f + g, and then subtract d.

Calculation of the area d + e + f + g

$$(4 - 3) \times 18 = 1 \times 18 = 18$$

Calculation of the triangle d

The area of a triangle is $\frac{1}{2} \times \text{the base} \times \text{the height}$

The base = 4 and the height = 1

$$\text{The area of d} = 0.5 \times 4 \times 1 = 2 \times 1 = 2$$

$$\text{Change in CS} = 18 - 2 = \$16 \text{ million}$$

Subject vocabulary

underground parallel markets an illegal market in goods or currencies that operates along side the legal market

non-price rationing mechanisms methods such as ration cards, waiting lists, and queuing that are used to ration goods and services to eliminate the excess demand when price is not allowed to rise

price ceiling the maximum legally allowable price set by government

market price the price determined by the interaction of demand and supply in a competitive market

Calculate the effect of a subsidy on society's welfare (HL) – a step-by-step guide

Trouble shooter

Welfare benefits = additional PS + additional CS = $32 + 16 = \$48$ million

Cost of the subsidy is the subsidy per unit multiplied by the number of units sold $\$3 \times 18 = \54 million

Benefit – cost = $48 - 54 = -6$

Overall welfare loss is $\$6$ million (area c + d)

Model sentence: A subsidy raises the price producers receive and lowers the price consumers pay, therefore consumer and producer surplus both increase leading to a gain in consumer and producer welfare. The cost to society of a subsidy is the subsidy per unit multiplied by the quantity sold which is paid by the tax payers. The costs outweigh the benefits, therefore the provision of a subsidy causes a welfare loss overall.

Test your understanding of this unit by answering the following questions

- Calculate the equilibrium price and quantity, and plot the demand and supply curves using the linear functions $Q_d = 21 - 2P$ and $Q_s = -3 + 4P$.
- Calculate the new equilibrium price and quantity after a subsidy of $\$1$ is placed on the good. Plot the new supply curve. Show and calculate the additional consumer and producer surplus and the welfare loss.

Learning Outcomes

- Explain why governments impose price ceilings and describe examples of price ceilings, including food price controls and rent controls.
- Draw a diagram to show a price ceiling and analyze the **impacts** of a price ceiling on market outcomes.
- Examine the possible **consequences** of a price ceiling, including shortages, inefficient resource allocation, welfare impacts, **underground parallel markets**, and **non-price rationing mechanisms**.
- Discuss the consequences of imposing a price ceiling on the stakeholders in a market, including consumers, producers, and the government.
- Calculate possible effects from the price ceiling diagram, including the resulting shortage and the change in consumer expenditure (which is equal to the change in firm revenue). (HL)

Subject vocabulary

quantity demanded the amount of a good consumers are willing and able to buy at a given price over a given period of time

quantity supplied the amount of a good that firms are willing and able to produce at a given price over a given period of time

market clears when quantity demanded equals quantity supplied and there is no surplus or shortage

Glossary

legally allowed by law

What are the effects of a price ceiling?

A **price ceiling** is set by the government. It is the maximum **legally** allowable price and its purpose is to reduce the good's **market price**.

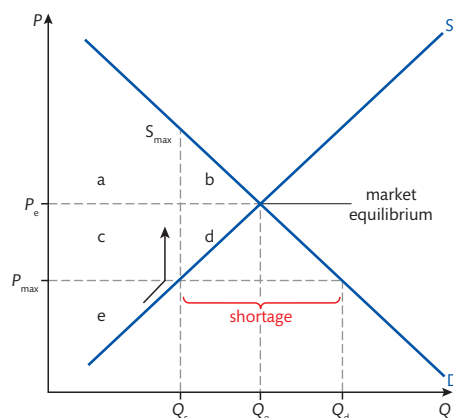


Figure 16.1

In Figure 16.1, at the equilibrium price P_e **quantity demanded** = **quantity supplied** and the **market clears**. A maximum price P_{\max} is set and price falls causing a movement down along the demand curve. Quantity demanded increases from Q_e to Q_d . At P_{\max} less profit is earned so firms reduce quantity supplied. There is a movement down and along the supply curve and quantity supplied falls from Q_e to Q_s . At P_{\max} quantity demanded is greater than quantity supplied. The shortage is Q_s to Q_d . In a free market the price would increase in order to **ration** the good and **eliminate** the shortage. As this cannot happen the good must be rationed in some other way.

The government can introduce **ration cards** that limit the amount each person can buy. Waiting lists and queues will form to ration use.

There are consumers willing and able to pay a higher price. There is an **incentive** for suppliers to act illegally and supply the good at prices above P_{\max} in an informal or black market. If this occurs then the supply curve is not vertical at P_{\max} but continues to slope upwards.

Welfare loss

When the market is in equilibrium the **sum** of **consumer and producer surplus** is maximized. Therefore society's total surplus and **welfare** is maximized at P_e . The area representing total welfare is $a + b + c + d + e$. After a price ceiling is set price cannot rise above P_{\max} therefore quantity supplied does not rise above Q_s . If no goods are supplied illegally on the black market at prices above P_{\max} the supply curve is vertical at P_{\max} . Total welfare is now area $a + c + e$. Area $b + d$ is the welfare loss.

In order to maximize society's welfare the price ceiling must be removed. Price will then rise and firms allocate more **factors of production** to the good in order to increase output and continue to do so until the shortage is eliminated and the market is in equilibrium. The firms must allocate a specific quantity of factors to the production of this good in order to produce output at Q_e . This is the point of allocative efficiency. It is the best or optimal **allocation** of **resources** from the point of view of society because welfare is maximized (the sum of C_s and P_s is maximized) at the equilibrium point $P_e Q_e$ (see pages 16–18 on allocative efficiency).

Why does the government set a maximum price?

For example, a government introduces rent controls in a city so that more people are able to afford to pay the rent and live and work there. In New York City rents on some properties are controlled. This is a benefit to those people who find a place to rent because they pay a rent below the market price. However, the maximum price can create a shortage of rented accommodation as the lower rent discourages quantity supplied.

A maximum price for a **staple food** such as bread reduces the price so more people can afford to buy the good. However, the effect of this government action leads to a fall in consumption of the good not an increase. Those who get the good at the maximum price are better off because they pay less for it but those who are unable to buy the good are worse off.

What action can the government take to increase consumption?

A **subsidy** placed on a good increases **profit** at each price and firms increase **supply**. If the correct amount of subsidy per unit is provided it will cause a parallel shift of the supply curve down and to the right so that quantity demanded equals quantity supplied at the maximum price and the shortage is eliminated. The subsidy increases consumption from Q_s to Q_d .

The government can produce the good increasing supply and thereby eliminating the **excess demand**. For example, the government could increase the supply of bread. Additional supply equal to the shortage causes a parallel shift of the supply curve to the right. Quantity demanded equals quantity supplied at the maximum price and the shortage is eliminated. Government supply of bread increases consumption from Q_s to Q_d .

Instead of increasing supply in order to increase consumption the government could encourage consumption by increasing demand. Advertising, for example, would increase demand causing the demand curve to shift up and to the right and quantity consumed would rise.

There are **opportunity costs** of all the government actions. Government revenue spent on subsidies or advertising, for example, cannot be spent on alternative goods and services.

Model sentence: The **imposition** of a price ceiling causes price to fall below the free market equilibrium price. At the lower price, quantity demanded increases and quantity supplied falls leading to a shortage of the good and a decrease in the amount of the good consumed.

Test your understanding of this unit by answering the following question

- Discuss the effects of the imposition of a maximum price in a market of your choice.

Glossary

ration card a card/voucher issued by a government to let the holder get goods that are in short supply

Synonyms

impacts..... effects

consequences.. results/
outcomes

ration..... allowing people
to have only a
fixed amount
of something
when there is a
shortage

eliminate remove/get rid
of

incentive..... encouragement/
motivation

sum..... total

allocation.... distribution

imposition .. introduction

Subject vocabulary

consumer surplus the
difference between the price
a consumer is willing and
able to pay and the price the
consumer actually pays

producer surplus the
difference between the price
a firm is willing to accept for
a unit of output and the price
the consumer actually pays

welfare the benefit gained
from consuming and
producing goods

factors of production the
inputs into the production
process (land, labour, capital
and entrepreneurship)

resources the inputs into the
production process, the factors
of production

staple food a food that
is eaten by lots of people,
particularly those on a
relatively low income

subsidy payments made by
government to firms per unit
of output

profit the difference between
total revenue and total cost

supply the amount of a good
that a firm is willing and able
to produce at each price

excess demand occurs when
quantity demanded is greater
than quantity supplied

opportunity cost the next
best alternative forgone

Subject vocabulary

consumer expenditure the money paid by consumers in exchange for a goods

producer revenue the income a firm receives from consumers in exchange for goods (revenue = price \times quantity sold)

price floor the minimum legally allowable price set by government

output the quantity of goods produced by a firm, industry or economy

Synonyms

expenditure... spending/
money spent

impose introduce

agricultural... farming

dispose (of) ... get rid of/
remove

allocation..... distribution

purchase..... buy

firm..... business/
producer/
supplier

Calculate the effects of a price ceiling (HL)

Before government intervention

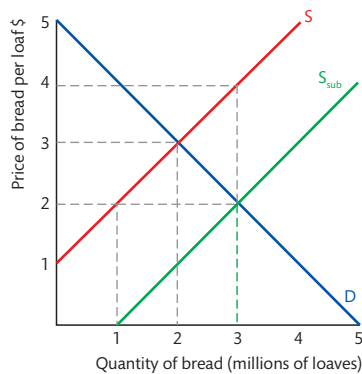


Figure 16.2

In Figure 16.2 equilibrium price is \$3 and quantity is 2 million. At \$3 quantity demanded = quantity supplied and the market clears.

Total **consumer expenditure** and **producer revenue** = price \times quantity = \$3 \times 2 million = \$6 million.

After intervention

A price ceiling of \$2 is set. At \$2 quantity demanded = 3 million and quantity supplied = 1 million.

The maximum price causes excess demand of 2 million (3 million – 1 million = 2 million).

Total consumer **expenditure** and producer revenue = price \times quantity sold = \$2 \times 1 million = \$2 million.

The fall in consumer expenditure and producer revenue caused by the price ceiling = \$6 million – \$2 million = \$4 million.

Eliminating the shortage

The government could impose a per-unit subsidy. Quantity demanded at the maximum price is 3 million.

To eliminate the shortage of 2 million, quantity supplied must increase to 3 million. As can be seen in Figure 16.2 the price needs to rise to \$4 in order to provide the incentive for firms to increase quantity supplied to 3 million. The per-unit subsidy necessary to eliminate the excess demand is the distance between the supply curves S and S_{sub} which is \$2. The total subsidy needed is the per-unit amount multiplied by the number of units to be subsidized = \$2 \times 3 million = \$6 million.

Learning Outcomes

- Explain why governments **impose price floors**, describe examples of price floors, including price support for **agricultural** products and minimum wages.
- Draw a diagram of a price floor and analyse the impacts of a price floor on market outcomes.
- Examine the possible consequences of a price floor, including surpluses and government measures to **dispose of** the surpluses, inefficient resource **allocation**, and welfare impacts.
- Discuss the consequences of imposing a price floor on the stakeholders in a market, including consumers, producers, and the government.
- Calculate possible effects from the price floor diagram, including the resulting surplus, the change in consumer expenditure, the change in producer revenue, and government expenditure to **purchase** the surplus. (HL)

What are the effects of a price floor on stakeholders and why do governments impose them?

A price floor set by the government is the minimum price a **firm** receives for a unit of **output**. The price is not allowed to fall below the minimum price. The purpose of a price floor is to increase market price.

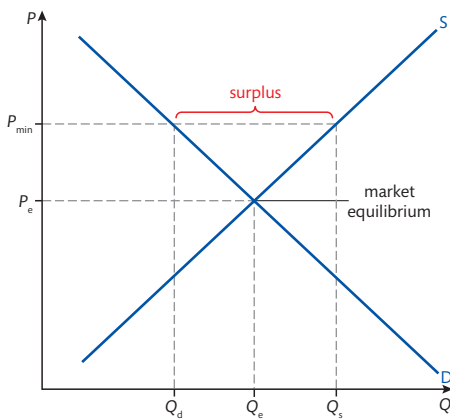


Figure 17.1

In Figure 17.1, the equilibrium price P_e quantity demanded = quantity supplied and the market clears. A minimum price P_{\min} is set. It is above equilibrium price. At this higher price quantity demanded falls from Q_e to Q_d . At P_{\min} more profit is earned so firms increase quantity supplied and it rises from Q_e to Q_s . Quantity supplied > quantity demanded. The **surplus** is Q_d to Q_s . In a free market the price would fall in order to eliminate the **excess supply** but this is not possible when a price floor is imposed.

After the minimum price is set the market is in **disequilibrium**. Encouraged by a higher price firms increase the **factors** allocated to the production of the good in order to increase quantity supplied from Q_e to Q_s . However, the value consumers place on the consumption of Q_s of output, as measured by the price they are prepared to pay for it, is far below P_{\min} , which is the price producers need to receive if they are to produce that amount. Consumers therefore will not buy all the output at that price. At P_{\min} consumers are only prepared to buy output up to Q_d , therefore there is a surplus of Q_d to Q_s . If the surplus is thrown away all the factors used to produce those goods are wasted. They could have been used to produce alternative goods that consumers would buy. Therefore a minimum price leads to an inefficient use of **scarce** factors as more wants could have been satisfied if those factors had been used to produce alternative goods.

Governments set a minimum price on some foods such as corn and wheat in order to guarantee output and to protect farmers' incomes. The price floor acts as an incentive for farmers to use their **resources** to produce the particular good. Consumers now pay a higher price and their **real incomes** and consumer surplus falls. Farmers benefit because **producer revenue** increases and they are more certain how much **income** they will earn in the future. The amount of the increase in revenue depends on how the government deals with the surplus.

What measures can government take to dispose of the surplus?

Increasing demand

The government increases demand by buying the excess supply ($Q_s - Q_d$). The demand curve shifts up and to the right until a new equilibrium is reached at P_{\min} and Q_s .

Government expenditure = $P_{\min} \times (Q_s - Q_d)$ and consumer expenditure = $P_{\min} \times Q_d$.

Total producer revenue = $P_{\min} \times (Q_s - Q_d) + P_{\min} \times Q_d = P_{\min} \times Q_s$.

$P_{\min} \times Q_s$ is the producer revenue after the minimum price is set and this is greater than $P_e \times Q_e$ which is the producer revenue in the industry before price controls are introduced.

This is a relatively large increase in producer revenue and income but it has cost the government $P_{\min} \times (Q_s - Q_d)$. There is an **opportunity cost** to this government expenditure. The money used to buy the surplus cannot be used to **invest** in other areas such as education.

The surplus bought by the government can be sold back to farmers as animal feed or exported at very low prices. The price the government pays the producers for the surplus is greater than the price received from selling it.

The government could simply throw away the surplus. This means that all the resources used to produce the good are wasted.

Reducing supply

The government pays farmers not to use their land to produce the good. This reduces supply and the **supply curve** shifts up and to the left. A new equilibrium can be reached at P_{\min} , Q_d if enough land is taken out of use to eliminate the excess supply. Quantity demanded = quantity supplied and the market clears but it has cost the government the amount it must pay farmers not to produce. There is an opportunity cost to this government expenditure and to do nothing with the land is a waste of scarce resources. Producer revenue increases because farmers get a higher price from the consumer and they get money from the government.

Subject vocabulary

surplus occurs when quantity supplied is greater than quantity demanded, another term for excess supply

excess supply occurs when quantity supplied is greater than quantity demanded

disequilibrium occurs in a market where the quantity supplied does not equal the quantity demanded at the actual price

factors of production the inputs into the production process (land, labour, capital and entrepreneurship)

resources the inputs into the production process, the factors of production

real income income after taking into account the effects of inflation on purchasing power

producer revenue the income a firm receives from consumers in exchange for goods (revenue = price \times quantity sold)

income the payment received by the factors of production (e.g. wages paid to labour, rent paid to the owners of land)

government expenditure spending by a government in a specified period of time on such things as transport infrastructure, welfare payments, national defense, education, and health services which is financed by tax revenue and borrowing

opportunity cost the next best alternative forgone

invest to buy capital goods and services

supply curve a graph that shows the relationship between price and quantity supplied

Synonyms

scarce..... limited/finite

Synonyms

expenditure...spending/
money spent

Subject vocabulary

price elasticity of demand (PED) a measure of how quantity demanded responds to a change in price in percentage terms

price elasticity of supply (PES) a measure of how quantity supplied responds to a change in price in percentage terms

supply the amount of a good that a firm is willing and able to produce at each price

price elastic the percentage change in quantity demanded/supplied > the percentage change in price

price inelastic the percentage change in quantity demanded/supplied < the percentage change in price

minimum wage the minimum amount of money a firm is legally allowed to pay a worker for one hour's work

classical/real-wage unemployment when wages are above the market clearing level leading to an excess supply of labour

consumer expenditure the money paid by consumers in exchange for a goods

consumer surplus the difference between the price a consumer is willing and able to pay and the price the consumer actually pays

Glossary

steep how high/big the angle/gradient is

wage payment made to labour

trade-off a situation that involves giving up something in return for gaining another thing

How does PED and PES affect the size of the surplus?

The size of the surplus and the size of the increase in **expenditure** and producer revenue depend on the difference between the equilibrium price and the floor price and the **price elasticity of demand** and **price elasticity of supply**. Look at Figure 17.1. If **supply** becomes more **price elastic**, quantity supplied at the minimum price rises and the surplus increases (you can see this by rotating the supply curve clockwise so that it is less **steep**). If supply becomes more **price inelastic**, quantity supplied at the minimum price falls and the surplus decreases. If demand becomes more inelastic and the demand curve becomes steeper, quantity demanded at the price floor increases and the surplus falls. When the surplus gets bigger government expenditure needed to buy it increases.

What are the effects of a minimum wage?

Governments set a **minimum wage**, which is an example of a price floor, to ensure workers can satisfy their basic needs. People supply their labour and firms demand labour. As **wage** rises so does the incentive to

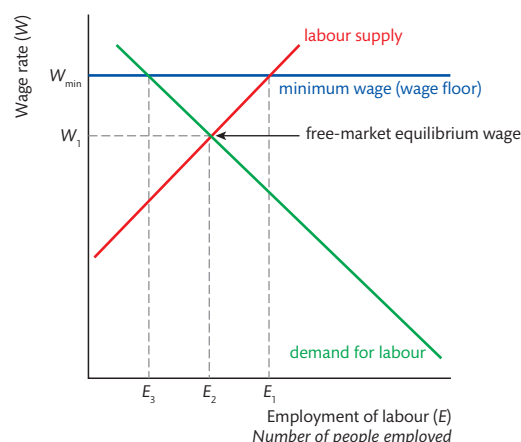


Figure 17.2

There is a **trade-off** between higher wages and employment. Those who are employed are better off but this is at the cost of higher unemployment. This type of unemployment is called **classical or real-wage unemployment**. It occurs when wages are above the market clearing level leading to an excess supply of labour.

Test your understanding of this unit by answering the following questions

- Explain the effects on employment and wages of the imposition of a minimum wage.
- Explain how price elasticity of demand and supply affect the surplus created by the imposition of a minimum price.

Calculate the effects of a minimum price (HL)

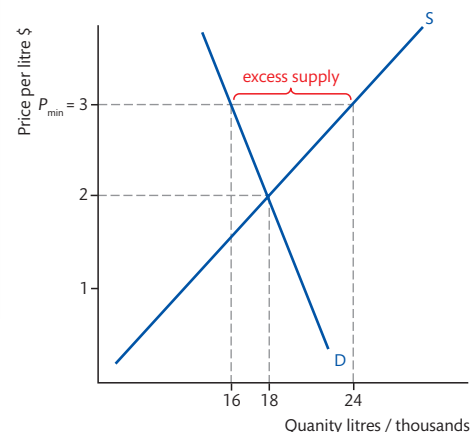


Figure 17.3

Equilibrium price for a litre of milk is \$2 and equilibrium quantity is 18 000 litres. A minimum price of \$3 per litre is set by the government. Quantity supplied increases to 24 000 litres and quantity demanded falls to 16 000 litres leading to a surplus of 8000 litres.

Consumer expenditure (price \times quantity) before the minimum price is set = $\$2 \times 18\,000 = \$36,000$. After the price floor is imposed expenditure = $\$3 \times 16\,000 = \$48,000$, an increase of \$12,000. Consumers pay a higher price per unit and **consumer surplus** falls.

If the government does not **intervene** in the market, producer revenue will be difficult to work out exactly. Producers try to sell the first 16 000 litres at \$3 per litre = $\$3 \times 16\,000 = \$48,000$. Producers will then sell the surplus at prices below \$3 per litre.

If the government reduces supply by paying farmers not to produce milk, total producer revenue will be \$48,000 plus the payments from the government.

If the government increases demand by buying the surplus (8000 litres) then producer revenue is the sum of consumer expenditure and the government expenditure on the surplus.

Consumer expenditure = $\$3 \times 16\,000 = \$48,000$

Government expenditure = $\$3 \times 8000 = \underline{\$24,000}$

Total producer revenue = $\$3 \times 24\,000 = \$72,000$

Synonyms

intervene get involved